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BY EMAIL AND RESS

November 27, 2020

Ms. Christine E. Long  
The Registrar  
Ontario Energy Board  
Suite 2700, 2300 Yonge Street  
P.O. Box 2319  
Toronto, ON M4P 1E4

Dear Ms. Long:

**EB-2020-0188 – Hydro One Networks Inc. Leave to Construct Application - Power Downtown Toronto LTC – Final CIA**

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Please see attached the final version of the Customer Impact Assessment for the above noted proceeding.

An electronic copy of this correspondence has been filed through the Ontario Energy Board's Regulatory Electronic Submission System.

Sincerely,

A handwritten signature in black ink, appearing to read "Joanne Richardson".

Joanne Richardson



Hydro One Networks Inc.  
483 Bay Street  
Toronto, Ontario  
M5G 2P5

**CUSTOMER IMPACT ASSESSMENT**  
**C5E/C7E Esplanade TS x Terauley TS**  
**HV Cable Replacement**

CIA ID: 2020-05  
Revision: Final  
Date: November 24<sup>th</sup> 2020  
Issued by: System Planning Division  
Hydro One Networks Inc.

Prepared by:

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Eva Ping  
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Hydro One Networks Inc.

Approved by:

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Farooq Qureshy  
Manager, Transmission Planning - Central  
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### **Disclaimer**

This Customer Impact Assessment was prepared based on preliminary information available about the proposed HV cable replacement of the circuits C5E and C7E between Esplanade TS and Terauley TS in downtown Toronto. It is intended to highlight significant impacts, if any, to affected transmission customers early in the project development process and thus allow an opportunity for these parties to bring forward any concerns that they may have including those needed for the review of the connection and for any possible application for leave to construct. Subsequent changes to the required modifications or the implementation plan may affect the impacts of the proposed connection identified in this Customer Impact Assessment. The results of this Customer Impact Assessment and the estimate of the outage requirements are also subject to change to accommodate the requirements of the IESO and other regulatory or municipal authority requirements. The fault levels computed as part of this Customer Impact Assessment are meant to assess current conditions in the study horizon and are not intended to be for the purposes of sizing equipment or making other project design decisions.

Hydro One Networks shall not be liable to any third party which uses the results of the Customer Impact Assessment under any circumstances whatsoever, for any indirect or consequential damages, loss of profit or revenues, business interruption losses, loss of contract or loss of goodwill, special damages, punitive or exemplary damages, whether any of the said liability, loss or damages, arises in contract, tort or otherwise.

## CUSTOMER IMPACT ASSESSMENT

### C5E/C7E ESPLANADE TS X TERAULEY TS HV CABLE REPLACEMENT

#### 1.0 INTRODUCTION

The Esplanade TS to Terauley TS 115kV underground cable circuits C5E/C7E provides a critical supply to the core of downtown Toronto. The 3.6km cable circuits have been in service since 1959 and are nearing end of life. The replacement of these cable circuits is essential.

In accordance with section 6 of the Ontario Energy Board’s Transmission System Code (“TSC”), Hydro One Networks Inc. (Hydro One) is to carry out a Customer Impact Assessment (“CIA”) study to assess the impact of this HV cable replacement on existing customers in the affected area.

This report presents the results of a Customer Impact Assessment (CIA) study completed by Hydro One to assess the potential impact of the proposed cable replacement on the transmission customers in the local vicinity. This study is intended to supplement the System Impact Assessment (SIA) CAA ID 2020-EX1104 entitled “C5E/C7E - Underground Cable Replacement”, issued by the IESO. In their report, the IESO concluded that there is no adverse impact of this project on the transmission system.

#### 2.0 BACKGROUND

The 115kV circuits C5E/C7E provides a critical supply to the core of downtown Toronto including Hospital Row, the University of Toronto, and Toronto City Hall. The 3.6km cable sections between Esplanade TS and Terauley TS are paper-insulated low-pressure oil-filled underground cables. They have been in service for over 60 years. The cable jackets and paper insulation were found to be in deteriorated condition which can lead to overheating, oil leaks, and cable failure. Furthermore, the oil pressure system has been a source of many nuisance oil leaks and is obsolete with few spare part suppliers. A part of these cables is buried under Queens Quay along Lake Ontario. A large oil leak would cause adverse environmental impact.

These cables are therefore proposed to be replaced by cross-linked polyethylene (XLPE) cables installed in a tunnel about 2.5km long on a different route. The cables will have a minimum summer continuous rating of 1200A. The current proposed in-service date is December 2024. The map and single-line diagram of this area are shown in Figure A1 and A2 in Appendix A.

#### 3.0 CUSTOMER LIST

The focus of this study is on transmission connected customers supplied by C5E and C7E circuits. The stations supplied by these circuits and the corresponding connected customers are listed in Table 1 below.

**Table 1: Connected Customers**

<b>Transformer Station</b>	<b>Customer</b>
Cecil TS	Toronto Hydro-Electric System Limited
Esplanade TS	Toronto Hydro-Electric System Limited
Terauley TS	Toronto Hydro-Electric System Limited

#### 4.0 STUDY RESULTS

Table 2 below compares the characteristics of the new cables with the existing cables for the subject replacement section of circuits C5E and C7E.

**Table 2: C5E and C7E Esplanade TS x Terauley TS Cable Electrical Characteristics**

Circuit	From Bus	To Bus	Length (km)	Existing (3.6km)			New (2.5km)		
				R (pu)	X (pu)	B (pu)	R (pu)	X (pu)	B (pu)
C5E	Terauley TS	Manhole A	1.835	0.001038	0.002633	0.036665	0.000364	0.004289	0.028442
	Manhole A	Esplanade	1.722	0.000853	0.002242	0.040458			
	<b>Total</b>		<b>3.557</b>	<b>0.001891</b>	<b>0.004875</b>	<b>0.077123</b>			
C7E	Terauley TS	Manhole A	1.835	0.001038	0.002633	0.036665	0.000367	0.004289	0.028442
	Manhole A	Esplanade	1.722	0.000869	0.002284	0.041214			
	<b>Total</b>		<b>3.589</b>	<b>0.001907</b>	<b>0.004917</b>	<b>0.077879</b>			

PU Voltage Base = 118.05kV

The cable replacement changes the route of the Esplanade TS x Terauley TS line section. The new cable length for this line section is about 1km shorter than the existing one. However, the total line impedance is slightly less. The reduction of the line impedance is not significant and therefore power flows, area station voltages and short circuits are not expected to be materially impacted by the change.

#### 4.1 Short- Circuit Studies

There is an insignificant increase in the fault level primarily at the Esplanade TS 115kV buses as a result of the HV cable replacement. The short circuit levels at all area HV and LV buses are given in Appendix B Tables 1 for the before and after scenarios.

All local customers are advised to review the short circuit results to ensure that their equipment ratings are adequate for the increased fault current level.

#### 4.2 Customer Reliability

The proposed cable replacement work will increase supply reliability for customers connected to these circuits as it reduces the chance of cable failure.

#### 4.3 Preliminary Outage Impact Assessment

The new cables will be routed in a different path than that of the existing cables. Therefore, no major outages are expected to impact the supply of customer's load. Exact outage schedule will be made available during the execution phase of the project and will be established in consultation with load customers in the area. The outage duration, if any, will be minimized and risk managed with proper outage planning and co-ordination.

## **5.0 CONCLUSIONS AND RECOMMENDATIONS**

This Customer Impact Assessment (CIA) study has reviewed the impact of the cable replacement for the local customers connected to these 115kV circuits C5E and C7E. The study concludes that the proposed project does not have any adverse impact on Hydro One Transmission customers.

The fault levels at the studied stations in the area experience an insignificant increase. Customers are requested to review the fault levels provided in Appendix B to ensure that the capability of their equipment is not exceeded.

6.0 APPENDIX A



Figure A1: Map of Toronto Downtown Core Showing Existing C5E/C7E Route and Future Tunnel Route

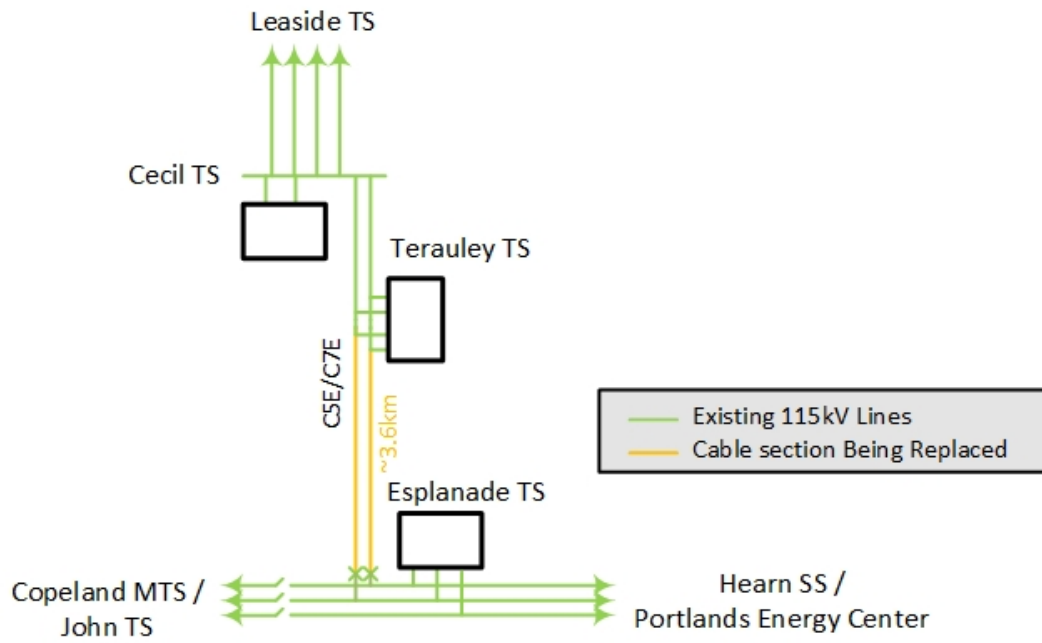


Figure A2: Simplified Single-Line Diagram of C5E and C7E



## 7.0 APPENDIX B

Table B1: Short Circuit Levels<sup>1</sup>

Area Station Buses	Base kV	Existing Fault Level (kA)				New Fault Level (kA)				Breaker Ratings (kA)	
		3-phase		Line to Ground		3-phase		Line to Ground			
		Sym	Asym	Sym	Asym	Sym	Asym	Sym	Asym	3ph Sym	3ph Asym
Cecil (HP Bus)	118.05	42.37	49.47	38.05	41.42	42.45	50.26	38.10	42.11	55	67
Cecil (A1A2 Bus)	13.8	18.75	22.33	1.96	2.62	18.75	22.37	1.96	2.62	11.2 <sup>2</sup>	12.3
Cecil (A3A4 Bus)	13.8	18.08	21.20	10.29	13.46	18.09	21.24	10.29	13.47	11.2 <sup>2</sup>	12.3
Cecil (A5A6 Bus)	13.8	18.80	22.56	10.48	13.76	18.81	22.60	10.48	13.77	28	30.8
Cecil (A7A8 Bus)	13.8	18.90	22.76	2.18	2.96	18.91	22.81	2.18	2.96	22.4	24.6
Esplanade (H2JK)	118.05	33.05	36.16	29.02	29.74	33.07	36.20	29.02	29.75	--	--
Esplanade (H10DE)	118.05	34.73	37.98	31.53	32.55	35.25	40.38	31.67	33.67	37.9	45.5
Esplanade (H9DE)	118.05	34.65	37.86	31.49	32.50	35.20	40.31	31.64	33.64	37.9	45.5
Esplanade (J Bus)	13.8	17.99	21.12	10.40	13.61	18.00	21.19	10.40	13.63	25	27.5
Esplanade (Q Bus)	13.8	17.02	19.76	1.95	2.59	17.03	19.82	1.95	2.59	25	27.5
Esplanade (A Bus)	13.8	19.31	22.47	1.97	2.62	19.32	22.56	1.97	2.62	20.3	24.4
Terauley (D1D2 Bus)	118.05	39.45	44.83	34.64	36.39	39.56	45.66	34.74	37.11	--	--
Terauley (D3D4 Bus)	118.05	39.47	44.84	34.64	36.39	39.58	45.68	34.73	37.11	--	--
Terauley (A1A2 Bus)	13.8	16.96	19.51	1.98	2.62	16.97	19.55	1.98	2.62	35	38.5
Terauley (A3A4 Bus)	13.8	15.39	17.90	1.96	2.61	15.39	17.93	1.96	2.61	17.5	19.2
Terauley (A5A6 Bus)	13.8	15.39	17.90	1.96	2.61	15.39	17.93	1.96	2.61	24.3	26.7
Terauley (A9A10 Bus)	13.8	18.60	21.40	1.99	2.64	18.60	21.44	1.99	2.64	31.5	34.7
Leaside (EJ Bus)	118.05	44.55	56.16	47.92	62.46	44.56	56.18	47.93	62.48	63 <sup>3</sup>	75
Leaside (KP Bus)	118.05	43.62	55.27	45.74	60.34	43.65	55.43	45.76	60.47	63 <sup>3</sup>	75
Hearn	118.05	46.17	52.41	45.26	52.51	46.20	52.49	45.27	52.61	63 <sup>4</sup>	80

<sup>1</sup> The short circuit study assumes all facilities in service with Leaside 115kV bus tie open and Hearn Bus tie close.

<sup>2</sup> LV transformer breakers only – they are not seeing the full fault current.

<sup>3</sup> Leaside Cap bank breakers rated at 40kA. However, fault level at Cap bank breaker is 31kA with series reactors.

<sup>4</sup> Hearn Cap bank breaker SC12SC rated at 40kA. However, fault level at Cap bank breaker is 31kA with series reactors.